

The final Section on Environmental Mineralogy opens with a reassuring exposition of the medical view by J. C. Gilson. D. R. Bowes, A. M. Langer, and A. N. Rohl bring us cautionary tales on the nature and range of mineral dusts in the environment, and A. A. Hodgson describes the mineralogical differences between the asbestos minerals; F. D. Pooley describes the application of an electron microscope microprobe analyser to the analysis of mineral dusts.

This is indeed a record of great progress and widened horizons in the Earth Sciences in the last few years and gives not only an indication of current research strengths but also suggests many likely lines of advance towards the twenty-first century. All mineralogists and petrologists will want it available in their libraries.

R. A. HOWIE

Bailey (D. K.) and Macdonald (R.), editors. *The Evolution of the Crystalline Rocks*. London, New York, and San Francisco (Academic Press), 1976. xii + 484 pp., 181 figs. Price £16.00.

The editors of this volume have set themselves a rather ambitious target, i.e. to produce a sequel to Bowen's book *The Evolution of the Igneous Rocks*. To this end they have enlisted the services of a number of distinguished experimental petrologists to write a series of articles with the common theme that the chapters should be on the application of experimental results to the understanding of the origin of rocks.

Part I on 'Experimental methods and the uses of phase diagrams' is by D. K. Bailey. He has kept the section on techniques rather brief because A. D. Edgar's book gives an up to date coverage of this topic. It is disappointing to find no mention in this section of ion-exchange equilibria techniques using chloride solutions or chloride melts as developed by Wyart and Sabatier over twenty years ago and used so successfully by the French experimental petrologists and in a few North American and Russian studies. These techniques have been extended to a number of elements other than Na and K and can provide information about both liquid solutions and solid solutions, which is not easily obtained by other methods.

The part of this chapter devoted to phase diagrams also has had to be abbreviated but it is clearly written and deals with P - T diagrams in some detail.

The second part of the book is divided into two sections viz Part IIA Metamorphic Rocks consisting of three chapters and Part IIB Igneous Rocks to which two chapters are devoted. The editors state that the coverage of metamorphism is more com-

plete since it is felt that the need for a sequel to Bowen's book is greater in this field. R. C. Newton and W. S. Fyfe contribute a chapter on 'High pressure metamorphism'. In this they review experimental studies of the minerals of the glaucophane-lawsonite schists and more briefly discuss eclogites, charnockites, and granulites. The section on the minerals, although very full of facts, is extremely well written and thus easy to read and to understand—if anything resembles the writing of N. L. Bowen, it is this section of this chapter. The other parts of this chapter on the eclogite and granulite facies come as somewhat of a relief to a teacher of petrology, such as the reviewer, who has been unable to provide a convincing explanation for the origin of these rocks—a relief to find that the experts still do not have answers. However, the statement 'It is clear that we must recognize wet and dry metamorphism of the same primary rock type under the same conditions of total pressure and temperature' appears to this reviewer as a complete acceptance of the hypothesis put forward by Yoder in his classic paper in the Bowen volume of the *American Journal of Science*: a hypothesis that has caused considerable divergence of opinion over many years among metamorphic petrologists.

'Metamorphism at moderate temperatures and pressures' was written by H. T. Greenwood and there is not surprisingly considerable overlap between this chapter and the chapter on 'Metamorphic petrology at low pressures and high temperatures' by W. Schreyer since both authors of necessity discuss the same systems. It might have been preferable for these two authors to have collaborated although both are very readable chapters as they stand. Schreyer concludes his chapter with some thoughts on the facies classification and comes to the same conclusion as H. G. F. Winkler, in the latest edition of his book, that the facies classification has outlived its usefulness. Schreyer believes that, provided we can put figures on pressure, temperature, fugacities of water, oxygen, etc., this is much more useful than mere classification.

Part IIB contains a chapter on 'Granitic rocks' by W. C. Luth and one on 'Alkaline rocks' by D. K. Bailey; topics on which each author has contributed significantly. There is a slight overlap where both authors discuss peralkaline systems—what writer can omit some reference to the peralkaline rhyolites and the evils of plotting them in the residua system? There is some 'self-plagiarism' in Professor Bailey's chapter but this can be forgiven in view of his particular interest in this rock type.

This reviewer feels that it is unfortunate that Professor Bailey should in two places reproduce Schairer's (1950) diagram for the system

NaAlSiO_4 - KAlSiO_4 - SiO_2 in which a ternary eutectic is shown at the junction of the fields of nepheline, feldspar, and leucite. In 1928, before this system had been studied experimentally, Bowen reasoned that this point should be a reaction point. When the phase diagram was first published by Bowen and Schairer in 1935, it showed a minimum on the nepheline-feldspar field boundary and the invariant point thus has to be a reaction point. Schairer (1950) omitted the arrow showing the minimum because he could not detect a difference in temperature between the supposed minimum and the invariant point, because of the difficulty of crystallizing the melts. Most subsequent authors have replaced the arrow because Bowen (1954) did so, as did Schairer (1957), and because in the system with water present it can readily be seen that the invariant point cannot be a eutectic. It seems unfortunate that this diagram continues to be copied in Schairer's version, which does away with the 'pseudoleucite reaction point' of Bowen.

On first reading the list of authors, the thought that came to the reviewer's mind was that there might be an analogy between the production of this book and that of a film in which there are a number of stars in the cast—such films tend to be disappointing if not financial failures. This book will not be a financial failure because publishers do not pay their writers well enough. What is disappointing is the very incomplete coverage of the igneous rocks and one can hazard a guess that one or two of the stars chosen for the cast did not put in an appearance.

Before the Second World War, only a few geology departments in the world would be sufficiently enlightened to recommend Bowen's book to their students so that it was published perhaps twenty or thirty years ahead of its time. At present no one could produce a useful book on any branch of petrology without reference to experimental studies. The situation is so changed that it is difficult to see how a sequel to Bowen's work could be produced. Nevertheless the aim was a worthy one; only time will tell how far the editors and authors have succeeded.

W. S. MACKENZIE

Yoder (H. S., Jun.). *Generation of Basaltic Magma*. Washington (Nat. Acad. Sci.), 1976. xii + 265 pp., 118 figs., 2 coloured pls. Price \$8.25 (cloth), \$5.50 (paper).

In 1972 the National Academy of Sciences of the U.S.A. awarded the first Arthur L. Day Prize and Lectureship to H. S. Yoder, with the stipulation that he should prepare this book. Those who are familiar with the author's distinguished research

career might be forgiven for fearing that his views on basalt genesis would be a tangle of tie-lines and tetrahedra. Far from it, the book is extremely broadminded in its approach to the subject. The tetrahedra are well represented but they are interwoven with sections on topics as diverse as volcanic plumbing, the origin of the earth, mantle geophysics, the thermal and dynamic requirements for mantle fusion, physicochemical constraints on melting, behaviour of rare-earth elements during basalt genesis, tectonophysics of melt accumulation and uprise, and the periodicity of volcanism.

The combination of Yoder's lucid prose and careful assessments of competing hypotheses with a low purchase price should make this book a 'must' for petrologists and most final-year geology undergraduates. The standard of production is as high as we have come to expect from all major Geophysical Laboratory publications, with abundant diagrams and a meticulous index.

As it is inevitable that this volume will play a major role in petrology teaching for many years to come, it should be stressed at the outset that this is not a textbook. To use Yoder's words in his preface, 'it would be an understatement to say the points of view are somewhat controversial'. He requests 'very critical analysis of each argument' and deserves this in many cases. For instance, Chapter 7 re-emphasizes Yoder's long-held view that the one-atmosphere phase relationships in Fe-free haplo-basaltic synthetic systems adequately explain the compositions and relative abundances of erupted basalts. Hence, he perpetuates the peculiar idea that the three 'parental' magmas amongst basalts contain the mineral assemblages olivine/plagioclase/Ca-rich pyroxene/Ca-poor pyroxene or olivine/plagioclase/Ca-rich pyroxene/nepheline or olivine/Ca-rich pyroxene/nepheline/melilite. Basalt with the assemblage olivine/plagioclase/Ca-rich pyroxene lies on a thermal divide in Yoder's scheme and it is clear from his text (pp. 128-31; especially footnote 1 on p. 130) that he does not regard this to be a quantitatively significant variant. Perhaps those petrologists investigating ocean-floor lavas, Iceland, the vast flood-basalt provinces, and countless other major occurrences would like to send the author a few thousand thin sections, to convince him that this is by far the most abundant terrestrial basalt type.

A final point to watch carefully is forewarned by another remark in the preface: that the reader 'should withhold judgement on an issue until completing the book . . . persuasive arguments in one section may be countered with equal vigor in another'. For instance, the popular concept that basic magma genesis frequently occurs by decompression melting during adiabatic upward convec-